

299-W15-765 (C3397)

Log Data Report

Borehole Information:

Borehole : 299-W15-765 (C3397)			Site:	West of TY Tank Fa	arm
Coordinates (Plant) GWL (ft) ¹ :		220.2 GWL Date : 9/27/01			
North	East	Drill Date	TOC ² Elevation	Total Depth (ft)	Type
		Sept. 2001	Unknown	265.5	Sonic

Casing Information:

		Outer Diameter	Inside Diameter	Thickness	Тор	Bottom
Casing Type	Stickup (ft)	(in.)	(in.)	(in.)	(ft)	(ft)
Steel thread	0.2 in.	10 3/4	9 3/8	11/16	0	265.5

Borehole Notes:

The BHI site geologist reported the GWL. According to the driller, casing to 265.5 ft and 0.5 ft of fill inside of casing indicates that the depth to bottom is 265.0 ft. The logging engineer measured the pipe stickup at the borehole using a steel tape. Calipers were used to measure casing outside diameter and inside diameter only. The casing thickness is calculated.

Logging Equipment Information:

Logging System:	Gamma 1D		Type: SGLS (35%)
Calibration Date:	09/00	Calibration Reference:	GJO-2001-243-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	RLS-1		Type: Moisture
Calibration Date:	07/01	Calibration Reference:	RLSM00.0 (Randall 2001)
		Logging Procedure:	MAC-HGLP 1.6.5

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4
Date	09/28/01	09/29/01	09/29/01	
Logging Engineer	Spatz	Spatz	Spatz	
Start Depth (ft)	0.0	266.0	137.0	
Finish Depth (ft)	137.0	138.0	110.0	
Count Time (sec)	200	200	200	
Live/Real	R	R	R	
Shield (Y/N)	N/A ³	N/A	N/A	
MSA Interval (ft)	1.0	1.0	1.0	
ft/min	N/A	N/A	N/A	
Pre-Verification	A0004CAB	A0004CAB	A0004CAB	
Start File	A0004000	A0004138	A0004267	
Finish File	A0004137	A0004266	A0004294	
Post-Verification	A0004CAA	A0004CAA	A0004CAA	
Depth Return Error (ft)	-0.04	N/A	-0.15	
Comments			Repeat section	

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2	3	4
Date	09/28/01	09/28/01	09/28/01	09/28/01
Logging Engineer	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	0.0	98.0	196.0	122.0
Finish Depth (ft)	100.0	198.0	220.5	100.0
Count Time (sec)	N/A	N/A	N/A	N/A
Live/Real	N/A	N/A	N/A	N/A
Shield (Y/N)	N/A	N/A	N/A	N/A
MSA Interval (ft)	0.25	0.25	0.25	0.25
ft/min	1.0	1.0	1.0	1.0
Pre-Verification	C0202CAB	C0202CAB	C0202CAB	C0202CAB
Start File	C0202000	C0202400	C0202800	C0202899
Finish File	C0202399	C0202799	C0202898	C0202986
Post-Verification	C0202CAA	C0202CAA	C0202CAA	C0202CAA
Depth Return Error (ft)	N/A	N/A	N/A	+0.10
Comments	None	None	None	Repeat section

Logging Operation Notes:

Zero reference is the top of ground surface, and log depths are relative to ground level. Water was detected below 220 ft. During logging, the sonde is centralized in the borehole for both the SGLS and NMLS.

A longer count time (200 sec) was required with the SGLS because of the relatively thick casing. The borehole was logged in the drill pipe before completion as a groundwater monitoring well. In order to obtain reliable spectra while minimizing overall logging time, the depth interval was increased from 0.5 ft to 1.0 ft.

Fine gain adjustments were not necessary during the SGLS logging runs. Log run 1 was terminated to refill the sonde with liquid nitrogen. The neutron log was run on a second logging truck, RLS-1.

Analysis Notes:

Analyst: Sobczyk	Date: 10/02/01	Reference:	MAC-VZCP 1.7.9 Rev. 2

Pre-run and post-run verification spectra for the SGLS were evaluated. The acceptance criteria for field verification of the Gamma 1D logging system are in the process of being established. Examinations of spectra indicate that the detector appears to have functioned normally during the log run, and the log data are provisionally accepted, subject to further review and analysis.

Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for a casing thickness of 11/16 in. from the ground surface to 266 ft. A correction for water in the borehole was applied below 220 ft, and this depth was determined from the neutron-moisture log. Dead time corrections were not necessary. The rerun of the SGLS showed good repeatability.

Pre-run and post-run verification spectra for the neutron tool were evaluated. The pre-survey verification spectrum (file C0202CAB) recorded 755 gross cps while the post-survey verification spectrum (file C0202CAA) recorded 716 gross cps.

Moisture calibration models at Hanford for 10-in. holes with 11/16-in. casing have not been established. Thus, the neutron log was not processed to estimate volumetric moisture content because the relatively large borehole diameter and casing thickness are beyond the range of conditions for which the tool was calibrated. Neutron data are presented as gross counts. In general, an increase in neutron count is indicative of an increase in moisture content, but a quantitative calculation of volumetric moisture cannot be made at

this time. The rerun of the neutron-moisture tool showed good repeatability with the exception that the two runs appear to be off-depth. This apparent discrepancy is due to acquiring data in continuous mode in different directions. During the original log, data was acquired while going deeper into the hole, and the data are shifted upward about 1.5 in. During the repeat logging, data were acquired while coming out of the hole, and the data are shifted downward about 1.5 in. In addition, the repeat log had a depth return error of 0.10 ft.

Log Plot Notes:

Separate log plots are provided for gross gamma, naturally occurring radionuclides (40 K, 232 Th, 238 U, and associated decay progeny), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. A gross neutron log of neutron counts is also shown on the combination plot.

Results and Interpretations:

¹³⁷Cs was the only man-made radionuclide detected. ¹³⁷Cs activity was detected from the ground surface to a depth of 6.0 ft. The measured ¹³⁷Cs activity was about 1.1 pCi/g at the ground surface decreasing to about 0.4 pCi/g at a log depth of 6 ft.

The changes in gross gamma counts depend primarily upon changes in ⁴⁰K activities. The increase in gross gamma counts from about 75 cps to about 110 cps at a log depth of 40 ft corresponds with an increase in apparent ⁴⁰K activity from about 10 to 17 pCi/g. This increase in total gamma is interpreted as the Hanford H2. The increase in ²³²Th activity from about 0.5 to 0.8 pCi/g and the increase in gross gamma counts from 110 to 135 cps at 93 ft are tentatively picked to represent the top of the Early Palouse Soil. On the basis of low K-40 activities, the carbonate-rich paleosols of the Pliocene-Pleistocene are interpreted as being between 101 and 115 ft. The caliche layer with characteristically high uranium content (greater than 2.0 pCi/g) is present between 111 and 113 ft.

Below 220 ft, the apparent increase in ²³⁸U activity based on 609-keV spectral line of about 1.0 pCi/g is greater than the apparent increase in ²³⁸U activity based on 1764-keV line of about ½ pCi/g. This apparent increase in ²³⁸U at groundwater may be the result of dissolved radon (²²²Rn) in the water, an incorrect water correction factor, or a combination of both. The apparent concentration based on the 609-keV peak appears to increase more than that based on the 1764-keV peak, because the water correction factor decreases with increasing energy level. If the source of the gamma photons is within the water, then there is less attenuation than would be expected, and the effect of the water correction is an apparent increase in the calculated concentration. Alternatively, the water correction factor may be too high, resulting in the apparent increase. At this time, the apparent increase in ²³⁸U at groundwater is under review, and the water correction will be changed if necessary.

The neutron moisture tool's depressed response in this hole is due at least in part to the low-activity source, short source-to-detector spacing, and large borehole diameter. The highest neutron counts occurred in the groundwater as expected. The higher neutron counts that occurred in the 93- to 115-ft interval correspond with the Plio-Pleistocene as interpreted from the SGLS data.

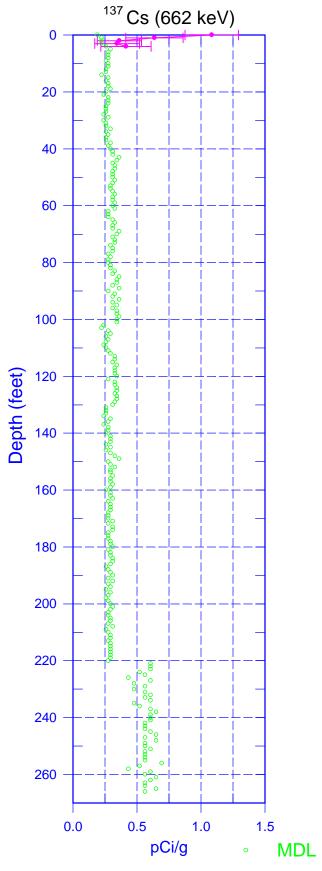
Reference: Randall, R., 2001. *Certificate of Calibration RLSM00.0*, July 11, 2001, Three Rivers Scientific, Richland, WA.

¹ GWL – groundwater level

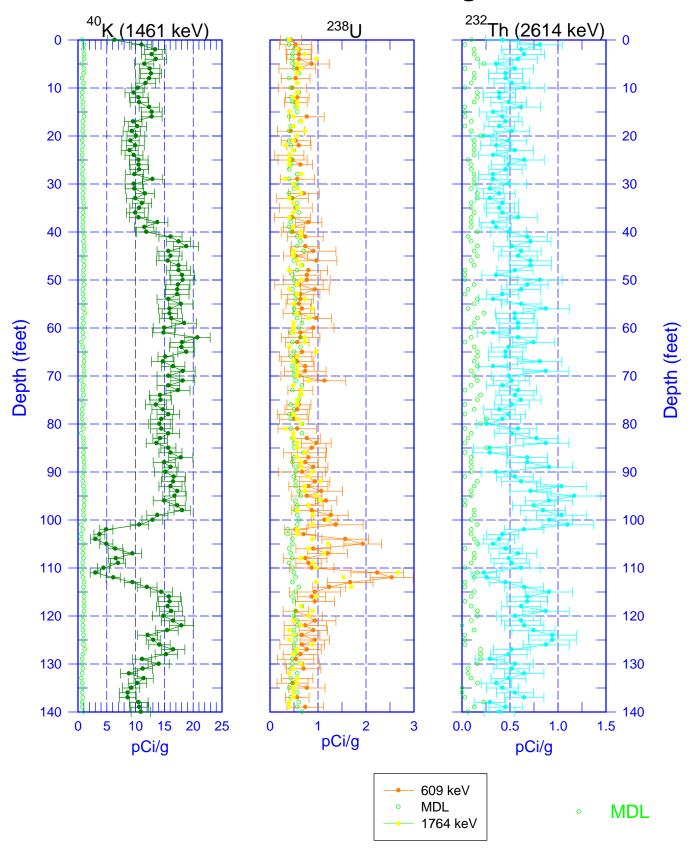
² TOC – top of casing

³ N/A – not applicable

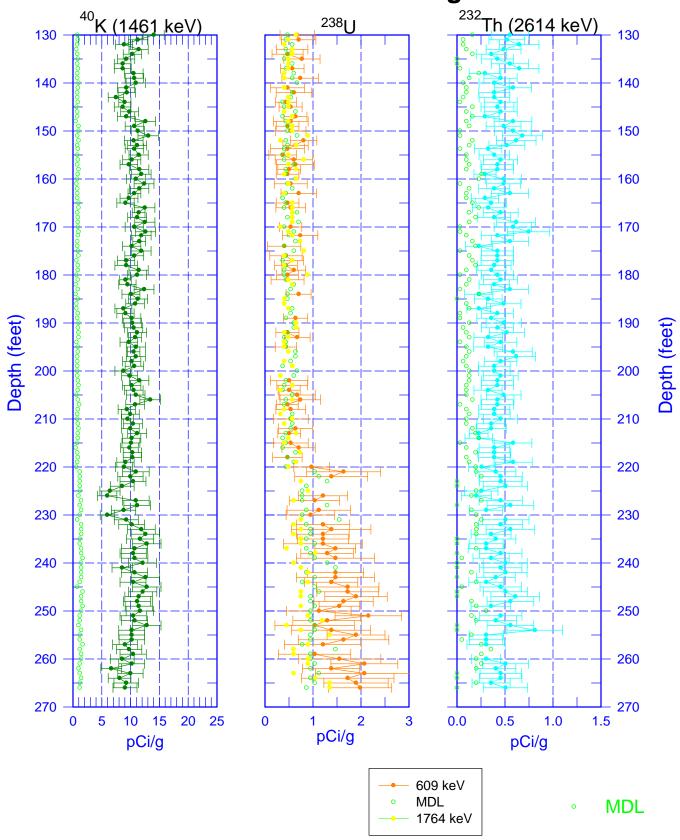
299-W15-765 (C3397) Man-Made Radionuclide Concentrations ¹³⁷Cs (662 keV)



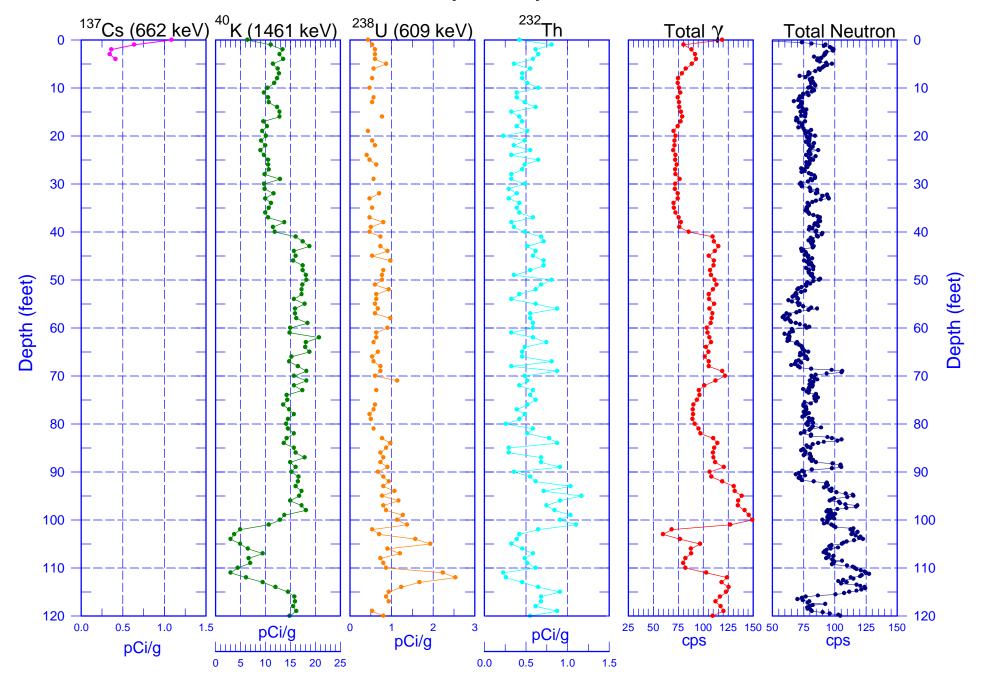
299-W15-765 (C3397) Natural Gamma Logs



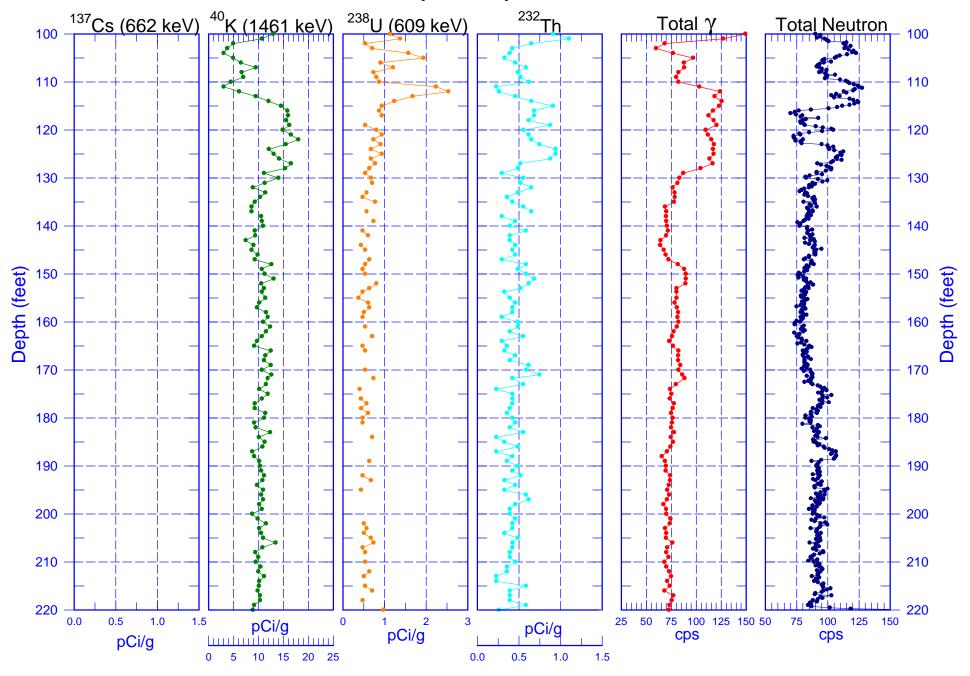
299-W15-765 (C3397) Natural Gamma Logs



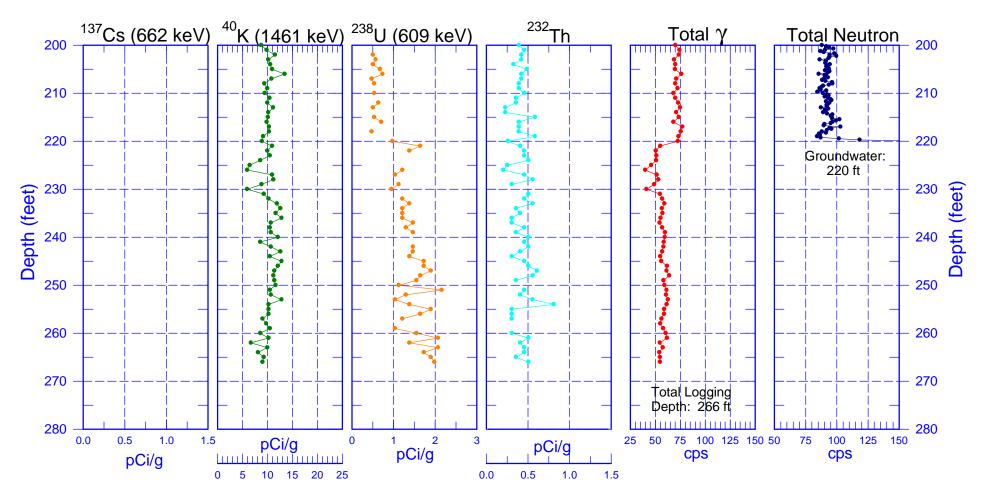
299-W15-765 (C3397) Combination Plot



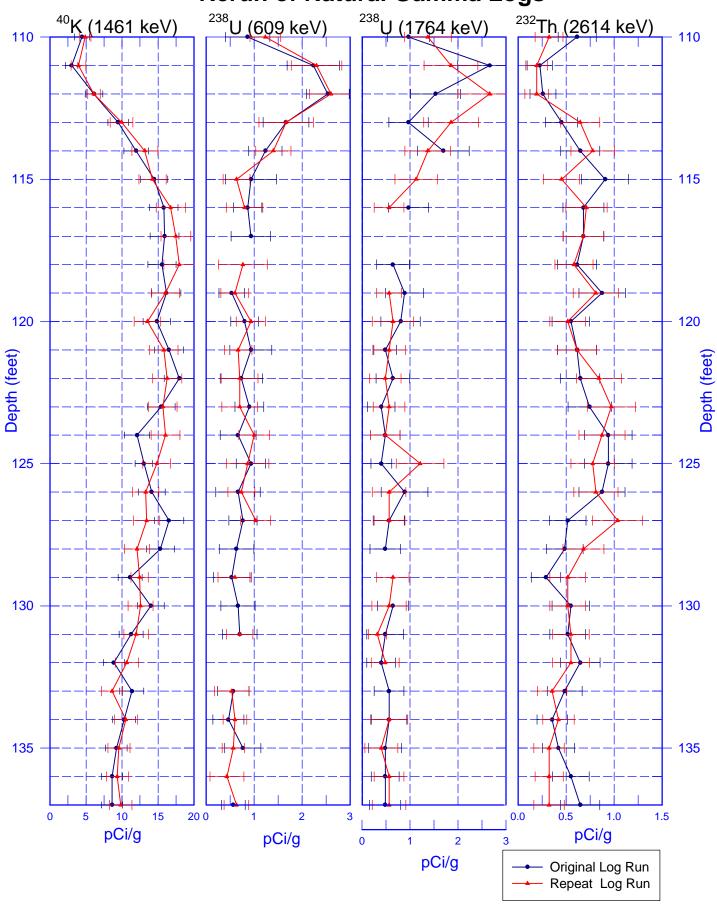
299-W15-765 (C3397) Combination Plot



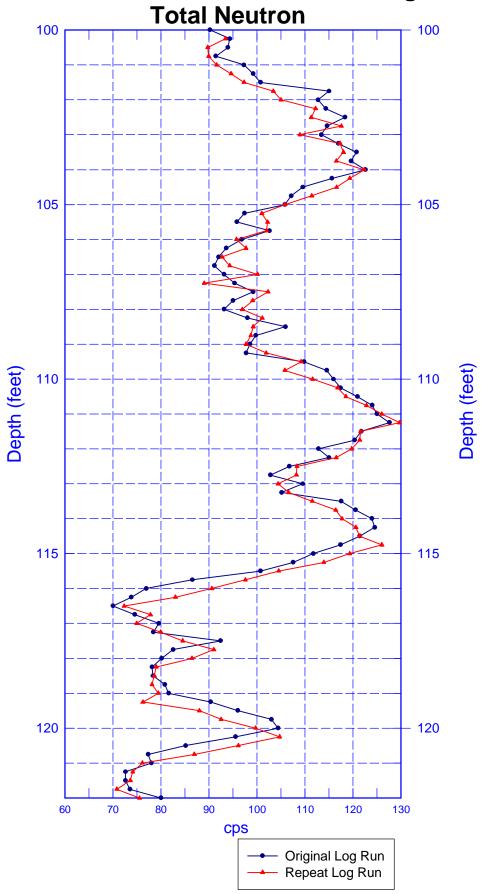
299-W15-765 (C3397) Combination Plot



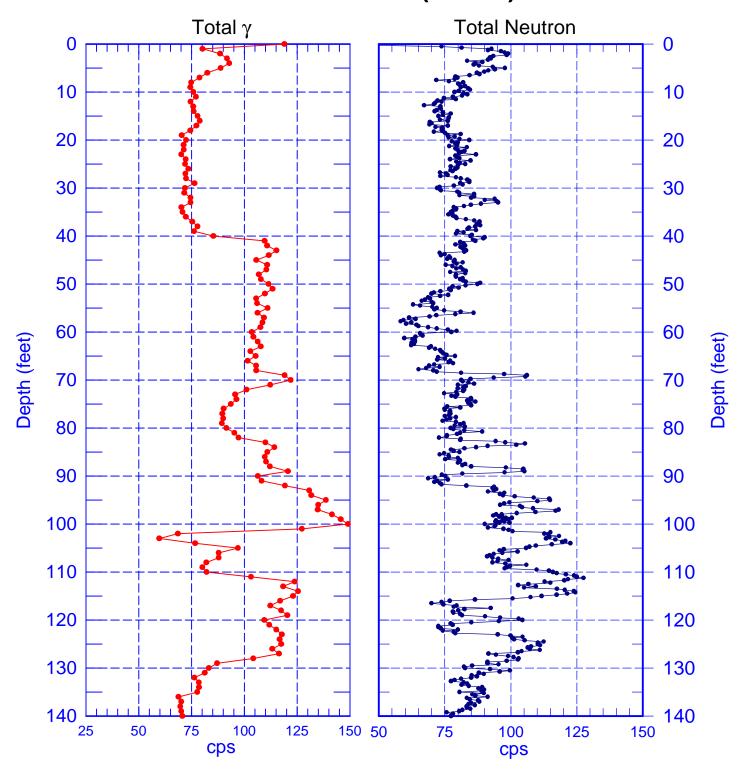
299-W15-765 (C3397) Rerun of Natural Gamma Logs



299-W15-765 (C3397) Rerun of Neutron-Moisture Log



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